

The NASA "Why?" Files
The Case of the
"Wright" Invention

Segment 2

The tree house detectives visit the Lemelson Center in the Smithsonian National Museum of American History. They speak with Mr. Michael Judd and learn that anyone can be an inventor and that a "formal" education is not always required to be a great inventor. Determined to be inventors, the tree house detectives return to Dr. D's Lab to learn how to find a solution to their problem. Dr. D introduces them to brainstorming, and after brainstorming for ways to make their bikes more visible at night, the tree house detectives consult with Ms. Catharine Fay of NASA Langley Research Center in Hampton, Virginia. Ms. Fay helps the tree house detectives learn how to set criteria in order to evaluate their ideas. One of the tree house detectives even gets a little help from the Wright brothers in the evaluation process. After evaluating their ideas, the tree house detectives visit Dr. Joycelyn Harrison in her lab at NASA Langley Research Center to find out about reflective materials. The tree house detectives are sure they are now on their way to becoming famous inventors.

Objectives

The students will

- learn about various inventors throughout history.
- learn how to make proposals to solve a problem.
- learn how to evaluate their solutions by setting criteria.
- understand that scientists review and ask questions about the results of other scientists' work.

Vocabulary

brainstorming - looking for solutions to problems by coming up with many possible answers

criteria - standards on which a judgment or decision may be based

evaluate - to decide the value or worth of something after a study

patent - a written document that allows an inventor exclusive rights to make, use, or sell an invention for a number of years

reflective - capable of reflecting light, images, or sound waves

solution - an answer to a problem

Video Component

Implementation Strategy

The NASA "Why?" Files is designed to enhance and enrich existing curriculum. Full use of the video, resources, activities, and web site usually requires two to three days of class time per segment.

Before Viewing

1. Prior to viewing Segment 2 of *The Case of the "Wright" Invention*, discuss the previous segment to review the problem and to discover what the tree house detectives have learned about the invention process so far.
2. Review the list of issues and questions that the students created prior to viewing Segment 1 and determine which, if any, were answered in the video or in the students' own research.
3. Focus Questions—Print the questions from the web site ahead of time to allow students time to copy them into their science journals. Remind students to look for the Focus Question icon as the answer to the focus question appears.

View Segment 2 of the Video

For optimal educational benefit, view *The Case of the "Wright" Invention* in 15-minute segments and not in its entirety. If you are viewing a taped copy of the program, you may want to stop the video when the Focus Question icon appears to allow students time to answer the question.

After Viewing

1. Lead students in a discussion of the focus questions for segment 1 and record answers.
2. Have students discuss and reflect in their science journals the "What's Up?" questions asked at the end of each segment.
3. Choose activities from the educator's guide and web site to reinforce concepts presented in the segment. The variety of activities is designed to enrich and enhance your curriculum.
4. Review criteria, evaluate ideas, and then have students work in groups or as a class to discuss the solutions that the tree house detectives brainstormed. Have students develop a list of criteria for each solution and guide students in the evaluation process. Discuss each and come to a class consensus on the best solution. Extend the discussion to include other possible solutions the tree house detectives could have chosen.
5. If time did not permit you to begin the web activity at the conclusion of Segment 1, refer to number 5 on page 13 and begin the Problem-Based Learning activity on the NASA "Why?" Files web site. If the web activity was begun, monitor students as they research within their selected roles and review criteria as needed. Encourage use of the following portions of the online Problem-Based Learning activity:



Careers

engineer
designer
lawyer
museum curator
historian
aviator

Research Rack - books, internet sites, and research tools

Dr. D's Lab - online simulations and hands-on activities for home or class

Media Zone - interviews with the experts in this program

6. Having students reflect in their journals what they have learned from this segment and from their own experimentation and research is one way to assess their understanding. If needed, give students specific questions to reflect upon.
7. The NASA "Why?" Files web site provides checklists and rubrics that may assist teachers in assessing students' understanding of the material presented. These items may be found in the "Tools" section of the educators' area.

Resources

Books

Egan, Lorraine Hopping: *Inventors and Inventions (Grades 4-8)*. Scholastic Trade, 1999, ISBN: 0590103881

Greenblatt, Jacquelyn A.: *Women Scientists and Inventors: A Science Puzzle Book*. Good Year Books, 1999, ISBN: 0673577287

Reid, Struan and Patricia Fara: *The Usborne Book of Inventors*. Scholastic, Inc., 1994, ISBN: 0590621750

Sobol, Donald: *Wright Brothers at Kitty Hawk*. Scholastic Paperbacks, 1989, ISBN: 0590429043

Sullivan, Otha Richard, James Haskins, Jim Haskins: *African American Inventors (Black Stars Series)*. John Wiley & Sons, 1998, ISBN: 0471148040

Thimmes, Catherine: *Girls Think of Everything: Stories of Ingenious Inventions by Women*. Houghton Mifflin, 2000, ISBN: 0395937442

Web Sites

The Lemelson Center, Smithsonian Museum of American History

The Jerome and Dorothy Lemelson Center for the Study of Invention is a place to explore the exciting world of invention. Whether you're a student, teacher, inventor, or history buff, you'll find things you can use. <http://www.si.edu/lemelson/>

Invention Dimension

Developed by MIT, this web site contains information on various inventors. The site has an "Inventor of the Week" and an alphabetical archive of past inventors. <http://web.mit.edu/invent/index.html>

The National Inventors Hall of Fame

This site celebrates the creative and entrepreneurial spirit of great inventors. The creative genius of invention is showcased through exhibits and presentations that allow visitors to experience the excitement of discovery, creativity, and imagination. <http://www.invent.org/book/>

The Internet Invention Store

Here's a really fun place to see some inventions. How about the "Remote Control Locator Device," which helps you find your lost TV remote control; all you do is clap your hands and it beeps to let you know it's hidden. You'll see pictures of each invention and get an idea of what is patentable. <http://catalog.com/impulse/invent>

Totally Absurd Inventions

Totally Absurd Inventions explores the funnier side of our inventive spirit by featuring actual USA-patented products! Take a glimpse into the minds of geniuses. Indulge yourself and behold the most incredible patents in the world! <http://www.totallyabsurd.com/>

Wacky Patent of the Month

This web site is devoted to recognizing selected inventors and their remarkable and unconventional patented inventions. <http://colitz.com/site/wacky.htm>

Kites in the Classroom

This site suggests uses of kites in the classroom and includes kite guides for students and worksheets and plans for teachers. http://www.aka.org.au/kites_in_the_classroom/

Activities and Worksheets

In the Guide

Who Invented That?

Learn about famous and not so famous inventors and their inventions.25

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Criteria

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Research, Research, and More Research *

Steps to help you research your ideas.29

It's a High Flying Kite

Build your own kite.30

On the Web

Would You Buy This Invention?

Learn to question and evaluate the results of other inventors' work.

* Activities for invention contest booklet



Purpose

Materials

1. Choose an inventor from the list below or pick one of your own.
2. Research the inventor and take notes on important and interesting facts about the person and the invention.
3. Share the information with your class or family by performing a skit, writing a report, creating a poster, or writing a newspaper article.

Gerardus Mercator
Evangelista Torricelli
Maria Mayer
Galileo Galilei
Hans Janssen
Leonardo da Vinci
Elmer Sperry
Henry Ford
Archimedes
Ruth Handler
Frank Epperson
Charles Darrow

Blaise Pascal
Margaret Knight
Isaac Newton
Alva Fisher
Sophie Germain
Stephanie Kwolek
Sonya Kovalevsky
Thomas Edison
Garfield Weston
Clive Sinclair
Ivan Sutherland

[illegible]

Brain Brewing Storms

Purpose

To study the process of thinking that enables inventors to dream up new ideas

Procedure

1. Discuss the rules of brainstorming:
2. Accept all ideas—there are no silly or bad ideas.
3. Record all ideas.
4. Produce a large number of ideas for a greater chance of finding a "winner."
5. Dare to dream up wild and "far-out" ideas because they can often become practical ideas.
6. Set a time limit.
7. Have one student in the group reach into the box and pull out an object.
8. Set the timer and list all suggested ideas for possible uses of the object.
9. After time is called, use the brainstorm web below to categorize your ideas. If you need more space, use the back of this sheet.
10. If time permits, repeat with other objects.

Materials

variety of junk objects
box or bag for objects
pencil
paper
timer or clock

Conclusion

1. Which ideas seem the most logical? Why? _____

2. Which ideas seem the most useful? Why? _____

3. What criteria did you use to sort the ideas? _____

4. Were the ideas you listed first your most creative ideas? Why or why not? _____

5. Did any oddball ideas turn into useful ideas? How? _____



What a Plan!

Use this worksheet to help plan your invention, but don't forget to record your plans in your inventor's log!

Problem

Solutions

List the top 5 solutions from your brainstorming:

1. _____
2. _____
3. _____
4. _____
5. _____

Criteria

Develop a list of criteria to aid in evaluating your ideas.

1. _____
2. _____
3. _____
4. _____
5. _____

Question

1. Ask yourself what makes a good invention? _____

2. Is it really a new idea? _____
3. Is it useful? _____
4. Will it be helpful to others? _____
5. Will it be reasonably priced so others can buy it? _____

Identify the Best Solution

After evaluating each solution or idea, choose the best one to solve the problem.

Verification

To help find out if your idea is a good one, conduct a survey. Survey your family and friends to get their opinions about your invention.

1. Do you think my invention will solve the problem?
2. Would you use my invention? Why or why not?
3. What would you pay for the invention?
4. (Write your own survey questions.)

Criteria

Problem

To establish criteria for evaluating solutions to problems

Procedure

1. With a partner or in a group, read the two examples.
Example 1 - instead of thinking of shoes as protecting your feet from the ground, think of using something to protect the ground from your feet.
Example 2 - instead of thinking about how you can carry peaches home from a store, think of how they can come to you - by delivery or by growing your own.
2. Decide which problem to solve and record it on your criteria sheet.
3. Using a timer or a clock with a second hand, brainstorm for ideas and possible solutions to the problem for 3-5 minutes. Record these ideas in your science journal and don't forget the rules for brainstorming!
4. Choose the top three ideas for evaluation and record them on the criteria sheet.
5. Determine the criteria list you will use to evaluate your ideas. Criteria can be anything. For example: inexpensive to make, easy to make, easy to use, and so on. Record your criteria on the criteria sheet.
6. On the evaluation grid for solution 1, using a scale of 1-5, with 5 being the best and 1 being the least, rank the solution according to how it meets each criterion.
7. Find the solution's total score by adding the numbers of points given to each criterion and record in the total ranking score column.
8. Repeat with the other two solutions and grids.
9. Determine which solution has the highest-ranking score. This solution should be pursued as a possible answer to the problem.
10. Discuss the pros and cons of the solution and present your solution to the class.

Materials

paper
pencil
criteria sheet
science journal
timer or clock

Criteria Sheet Evaluation Grid

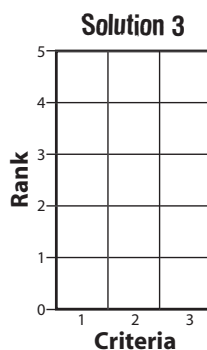
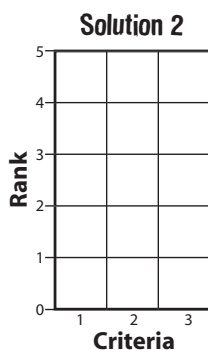
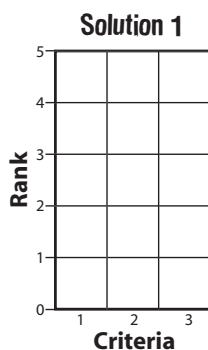
Problem _____

Solution 1 _____

Solution 2 _____

Solution 3 _____

Evaluation Grids



Ranking Total Scores

Solution 1 _____

Solution 2 _____

Solution 3 _____

The best solution
according to
our criteria _____



Research, Research, and More Research

Research is the gathering of facts and information that enables you to approach a subject with as much knowledge as possible. In the invention process, research is critical so that you have adequate knowledge to evaluate your idea. It is during this stage of the invention process that you should make changes in your invention or even decide to throw it out and start over. Don't be afraid to do whatever it takes to make your invention the best possible invention you can make!

Below, read the suggestions on how to research your invention. Brainstorm for ideas for each suggestion and plan your research carefully. Be sure to record your research in your Inventor's Log.

1. Research to see if your idea already exists:
 - a. check retail stores
 - b. check catalogs
 - c. write or e-mail related businesses
 - d. check with the U.S. Patent Office
2. Go to the library to research similar ideas or inventions.
3. Conduct an internet search for your invention.
4. Talk to experts in your community that might know of similar inventions.

Use the research collected and answer these questions to see if you are on track:

	YES	NO
1. Is my idea original?	<input type="checkbox"/>	<input type="checkbox"/>
2. Will my idea solve my problem?	<input type="checkbox"/>	<input type="checkbox"/>
3. Is my invention easy to make?	<input type="checkbox"/>	<input type="checkbox"/>
4. How will my invention work?	<input type="checkbox"/>	<input type="checkbox"/>
5. Is my invention useful?	<input type="checkbox"/>	<input type="checkbox"/>
6. Is my invention safe to use?	<input type="checkbox"/>	<input type="checkbox"/>
7. Is there an easier or better way to solve the problem?	<input type="checkbox"/>	<input type="checkbox"/>

If you answered yes to 1-6, you are on your way and ready to begin designing a model for testing!

It's a High Flying Kite

Problem

To learn how to make a kite

Teacher Prep

Using a sharp knife, carefully make a deep notch on the ends of each stick.

Procedure

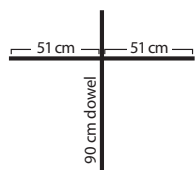


Diagram 1



Diagram 2

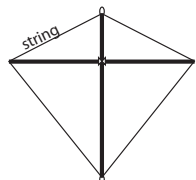


Diagram 3

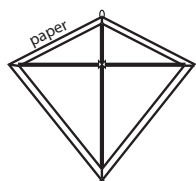


Diagram 4

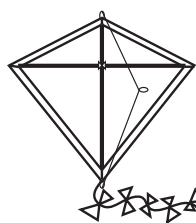


Diagram 5

Materials

thin twine/string
transparent tape or glue
102-cm X 102-cm sheet of strong paper
90-cm wooden dowel or stick
102-cm wooden dowel or stick
plastic bag
scissors
metric ruler
markers or crayons to decorate the kite

1. Measure 51 cm from one end of the 102-cm dowel. Mark the spot with a marker or pencil.
2. Lay the 90-cm dowel across the top of the 102-cm dowel so that they form a cross at the spot marked above. See diagram 1.
3. Using string, tie the two sticks together, making sure that they remain at right angles to each other. To strengthen the connection, place a dab of glue at the joint.
4. Cut a piece of string long enough to fit around the kite frame and then add 10 cm.
5. On one end of the string, make a loop and tie a knot to secure the loop.
6. Place the string into the top notch of the kite frame, leaving the loop free. Wrap the string around the stick a few times to secure. See diagram 2.
7. Stretch the string through the notch in the cross piece and to the bottom notch (opposite of top with loop). Mark this point on the string. *Note: The string must be taut but not so tight that it makes the sticks bend.*
8. At that mark, make another loop and tie it off with a knot. Place the string with the loop into the bottom notch and secure by wrapping the string around the stick a few times.
9. Continue to stretch the string through the notch on the other end of the cross piece and back to the top. Tie off by wrapping the string around the dowel and tie off with a knot to secure. See diagram 3.
10. Cut off any excess string.
11. Decorate the center of your paper that will be used for the kite.
12. Lay the paper face down on a smooth flat surface and place the stick frame on top of the paper.
13. Cut the paper around the frame, leaving a 3-4 cm margin. For better accuracy, measure 3-4 cm from the frame and mark with a pencil; then remove the frame and cut along markings.
14. Fold the edges of the paper over the string frame and tape or glue it down, making sure that the paper is pulled tight. See diagram 4.
15. To make the kite's bridle, cut a piece of string about 125-cm long and tie one end of the string to the top loop.
16. Come down from the top about 1/3 of the way and make a small loop in the string just above the intersection of the two cross pieces. This section is where you attach the kite's string to fly the kite.
17. Tie the other end of the string to the bottom loop. See diagram 5.
18. To make a tail for the kite, cut a plastic bag into strips approximately 5 cm x 20 cm. Tie the strips to a piece of string, spacing them about 10 cm apart.
19. Attach the tail to the bottom loop.
20. Attach string to center loop of the kite's bridle.
21. Fly your kite and enjoy!

Just for Fun

Orville Wright was an expert at making kites. He often sold them to playmates for spending money. The children in the neighborhood loved his kites because they had such good flying qualities. That was because Orville made the frame so thin that it bent in the wind. Even though Orville was too young to realize that this curvature contributed greatly to the kite's good flying qualities, it aided him years later as he built kites that helped him to achieve successful flight.

